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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/990,390	11/23/2001	Ofer Shtrichman	SHTRICHMAN	2863

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EXAMINER
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FERRIS III, FRED O

ART UNIT	PAPER NUMBER
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2128

DATE MAILED: 07/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/990,390

Applicant(s)

SHTRICHMAN, OFER

Examiner

Fred Ferris

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 23 November 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 11/23/01.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. *Claims 1-27 have been presented for examination based on applicants disclosure filed 23 November 2001. Claims 1-27 have been rejected by the examiner.*

*Antecedent*

### **Drawings**

2. *Applicant's drawings submitted on 23 November 2001 have been approved by the examiner.*

### **Claim Rejections - 35 USC § 101**

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. ***Claims 1-9 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.***

*Per independent claims 1 and 5: The Examiner submits that method claims 1 and 5, as written, are merely drawn to a mental process for analyzing formulas, since the language of the claims can be interpreted as meaning the method is carried out by a mental process augmented (calculated) using pencil and paper. (i.e. not a machine or computer process)*

***MPEP 2111 [R-1] recites the following:***

***"2111 [R-1] Claim Interpretation; Broadest Reasonable Interpretation  
CLAIMS MUST BE GIVEN THEIR BROADEST REASONABLE  
INTERPRETATION***

***During patent examination, the pending claims must be "given their broadest reasonable interpretation consistent with the specification." In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000).< Applicant always has the***

opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. In *re Prater*, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969) (Claim 9 was directed to a process of analyzing data generated by mass spectrographic analysis of a gas. The process comprised selecting the data to be analyzed by subjecting the data to a mathematical manipulation. The examiner made rejections under 35 U.S.C. 101 and 102. In the 35 U.S.C. 102 rejection, the examiner explained that the claim was anticipated by a mental process augmented by pencil and paper markings. The court agreed that the claim was not limited to using a machine to carry out the process since the claim did not explicitly set forth the machine. The court explained that "reading a claim in light of the specification, to thereby interpret limitations explicitly recited in the claim, is a quite different thing from reading limitations of the specification into a claim, to thereby narrow the scope of the claim by implicitly adding disclosed limitations which have no express basis in the claim." The court found that applicant was advocating the latter, i.e., the impermissible importation of subject matter from the specification into the claim.). See also *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997) (The court held that the PTO is not required, in the course of prosecution, to interpret claims in applications in the same manner as a court would interpret claims in an infringement suit. Rather, the "PTO applies to verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in applicant's specification.")"

The Examiner further submits that, in view of the language of the claims, Applicant's have merely claimed a manipulation of abstract ideas by a mental process and have not specifically set forth a machine or computer process.

Section 2106 [R-2] (Patentable Subject Matter — Computer-Related Inventions) of the MPEP recites the following:

"In practical terms, claims define nonstatutory processes if they:  
– consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or  
– simply manipulate abstract ideas, e.g., a bid (*Schrader*, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (*Warmerdam*, 33 F.3d at 1360, 31 USPQ2d at 1759), without some claimed practical application."

In this case, independent claims 1 and 5 are simply drawn to the manipulation of abstract ideas by a mental process of analyzing formulas by mathematical algorithm. Dependent claims 2-4, and 6-9 inherit the defects of the claims from which they depend.

### ***Claim Interpretation***

4. *Applicants are disclosing a method, apparatus, and computer product for making the SAT problem easier to solve and reducing computation time by constraining the search space for subsequent computational iterations through the addition of conflict clauses. The examiner notes that this feature appears to be disclosed in prior art Gupta at column 4, line 30. The conflict clauses of the claimed invention are computed and analyzed using known methods (Marques-Silva, backtrack search algorithm) and added to a CNF formula (also referred to as the "clause database") as constraints on the search. A conflict clause represents an auxiliary sub-formula, such that any assignment that fails to satisfy the sub-formula will invariably lead to a conflict in the original formula. Applicants have further noted that the question of how to identify pervasive conflict clauses outside the fixed framework of the circuit formula itself remains an open issue. (Page 6, lines 27-29)*

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. *Claims 1-4 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.*

*Specifically, independent claim 1 recites the term "express constraint" that has not been sufficiently defined in the specification such that a skilled artisan could make and/or use the invention. While, the specification makes reference to "the formulas including clauses that include variables and express constraints on states of the system" (para: 0024), there is no clear and concise definition of the term "express constraints" in specification. For purposes of art rejections, the examiner has assumed that applicants are merely referring to expression constraints (i.e. boolean) as taught in the prior art.*

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**6. Claims 1-3, 10-12, and 19-21 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by "GRASP – A New Search Algorithm for Satisfiability", Silva et al, ICADD 96', IEEE 1063-6757/96, 1996 IEEE.**

*Independent claim 1, for example, is drawn to:*

method for SAT testing, given 1<sup>st</sup> & 2<sup>nd</sup> formulas describing target system, including clauses, variables, express constraints on states of the system by:

- analyzing first formula to deduce conflict clauses expressing variable assignment that prevent a conflict, which 1<sup>st</sup> formula not satisfied, while determining the 1<sup>st</sup> formula clauses that lead to conflict;

- identifying conflict for clauses that lead to conflict in 1<sup>st</sup> formula as subset of clauses in 2<sup>nd</sup> formula;

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- analyzing 2<sup>nd</sup> formula conflict clauses to determine whether 2<sup>nd</sup> formula can be satisfied.

Regarding independent claim 1: Silva teaches a computer implemented method for SAT testing (Section 1.0, 2.2) inclusive of a CNF formula clause database (i.e. "conflict clause" database, Section 2.2) for applications relating to computer aided design of integrated circuits, test pattern generation, and logic verification (i.e. a represented "target system", Section 1.0, para: 1) from formulas including clauses, variables and express constraints (Sections 1.0, 2.1). Silva further discloses analyzing given formula (i.e. a first formula, Section 2.1) for the purpose of deducing conflicts to be included in a clause database (i.e. a "conflict clause", Section 2.2, 3.1-3.2), expressing the variable assignments that prevent conflicts (3.1-3.2, especially 3.1.2), and subsequently analyzing additional formulas (i.e. second formula) and identifying conflicts (Sections 1.0 (para: 5), 2.1-2.4, i.e. an original set and second set (subset) of clauses) and determining if the formulas can be satisfied (Sections 2.3-2.4).

Per dependent claims 2-3: Silva further teaches clauses formulated in conjunctive normal (CNF) form (Section 2.1), and determining whether conflict clauses lead to second subset (Sections 1.0 (para: 5), 2.1-2.4).

Regarding claims 10-12: Claims 10-12 are apparatus claims that include the same limitations as method claims 1-3 and are therefore rejected using the same reasoning cited above.

Regarding claims 19-21: *Claims 19-21 are software product claims that include the same limitations as method claims 1-3 and are therefore rejected using the same reasoning cited above.*

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

**7. *Claims 4-9, 13-18, and 22-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over "GRASP – A New Search Algorithm for Satisfiability", Silva et al, ICADD 96', IEEE 1063-6757/96, 1996 IEEE in view of "Symbolic Model Checking using SAT procedures instead of BDD's", Biere et al, DAC 99', pp. 317-320, ACM 1999.***

Regarding independent claim 5: *As noted above, Silva teaches a computer implemented method for SAT testing (Section 1.0, 2.2) inclusive of a CNF formula*



*clause database (i.e. "conflict clause" database, Section 2.2) for applications relating to computer aided design of integrated circuits, test pattern generation, and logic verification (i.e. a represented "target system", Section 1.0, para: 1) from formulas including clauses, variables and express constrains (Sections 1.0, 2.1). Silvia further discloses analyzing given formula (i.e. a first formula, Section 2.1) for the purpose of deducing conflicts to be included in a clause database (i.e. a "conflict clause", Section 2.2, 3.1-3.2), expressing the variable assignments that prevent conflicts (3.1-3.2, especially 3.1.2), and subsequently analyzing additional formulas (i.e. second formula) and identifying conflicts (Sections 1.0 (para: 5), 2.1-2.4, i.e. an original set and second set (subset) of clauses) and determining if the formulas can be satisfied (Sections 2.3-2.4)*

*Silva does not explicitly disclose generating a succession of bounded model checking (BMC) in describing a target system.*

*Biere teaches the use of bounded model checking (BMC) of a model (representing a target system) by constructing (generating) a propositional formula that is satisfiable (Sections 1.0 (para: 3), 2-4). Biere further discloses analyzing by BMC for a satisfying assignment of variables corresponding to the model (Section 2.2, para: 6).*

*It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Silva relating to SAT testing inclusive of a CNF formula clause ("conflict clause") database, with the teachings of Biere relating to the use of bounded model checking (BMC) of a model by constructing (generating) a propositional formula that is "satisfiable", to realize the elements of the*

*claimed invention. An obvious motivation exists since, in this case, the Silva reference teaches to the Biere reference, and the Biere reference teaches to the Silva reference. Specifically, both Silva and Biere teach SAT testing and are used in the same technological arena as noted above. Silva teaches to Biere because Silva teaches SAT testing and conflict clause analyzing of a target systems including integrated circuits and test pattern generation. (See: Silva, Introduction). Biere teaches to Silva because Biere specifically teaches employing BMC in SAT based testing. (See: Biere: Introduction) Further, the level of skill required by an artisan to realize the claimed limitations of the present invention is clearly established by both references. (See: Silva/Biere, Background/Abstract) Accordingly, a skilled artisan having access to the teachings of Silva and Biere, would have knowingly modified the teachings of Silva with the teachings of Biere (or visa versa) to realize the claimed elements of the present invention while reducing the cost and development time.*

*Regarding dependent claims 4 and 6-8, 13 and 22: Biere teaches BMC and would have knowingly been incorporated by a skilled artisan using the reasoning cited above. Silva teaches identifying conflict clauses (Sections 2.2, 3.1-3.2) and would have knowingly been modified by a skilled artisan to include the BMC instances (Sections 1.0 (para: 3), 2-4) of Biere also using the reasoning cited above.*

*Regarding dependent claim 9: Silva further teaches clauses formulated in conjunctive normal (CNF) form (Section 2.1), and determining whether conflict clauses lead to second subset (Sections 1.0 (para: 5), 2.1-2.4) as noted above.*

Regarding claims 14-18: Claims 14-18 are apparatus claims that include the same limitations as method claims 5-9 and are therefore rejected using the same reasoning cited above.

Regarding claims 23-27: Claims 23-27 are software product claims that include the same limitations as method claims 5-9 and are therefore rejected using the same reasoning cited above.

### **Conclusion**

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 6,728,665 issued to Gupta et al teaches SAT testing and BMC.

"Boolean Satisfiability in Electronic Design Automation", Marques-Silva et al, DAC 2000, pp. 675-680, ACM 2000 teaches SAT testing and BMC.

"Satisfiability-Based Layout Revisited: Detailed Routing of Complex FPGA's Via Search-Based Boolean SAT", Nam et al, FPGA 99', pp. 167-175, ACM 1999 teaches SAT testing and BMC.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the

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*examiner by telephone are unsuccessful, the examiner's supervisor, Jean Homere can be reached at 571-272-3780. The Official Fax Number is: (703) 872-9306*

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*W2128*